Using a Geometric Site Selection Design in Watershed Assessments to Support TMDL Development

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Watershed Monitoring & Assessment

Where

- Inland rivers & streams of Ohio (1980 – present)
- Intensive rotating basin approach, watershed design
- 100-300 mi^2 study areas; large river mainstems

What

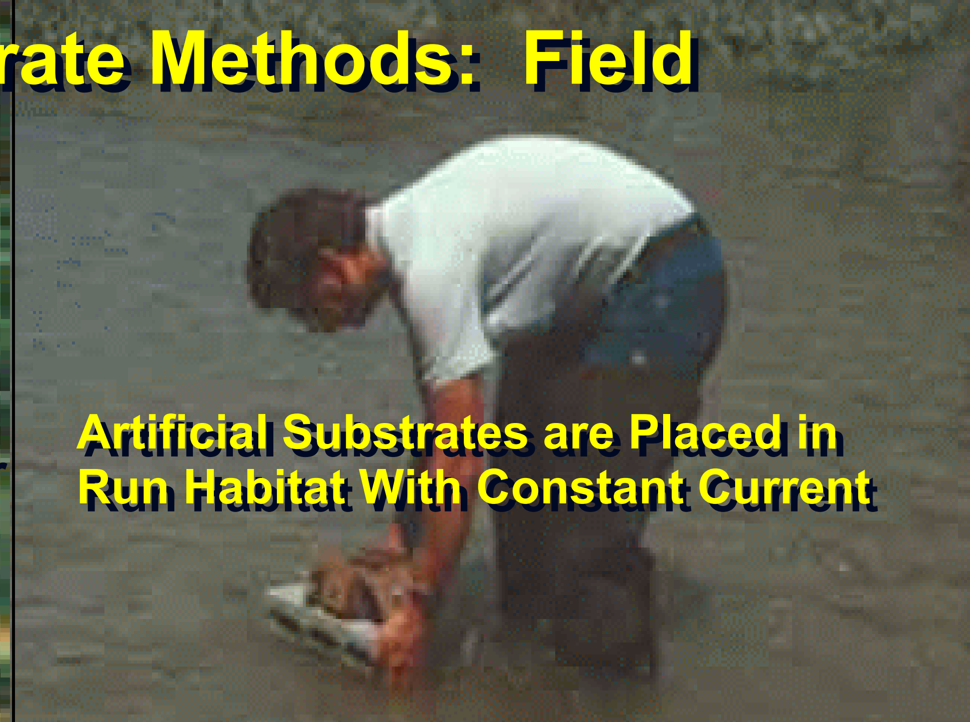
- Fish, macroinvertebrates, physical habitat
- Water quality, sediment chemistry, fish tissue
- Other assessment tools added as needed

Why

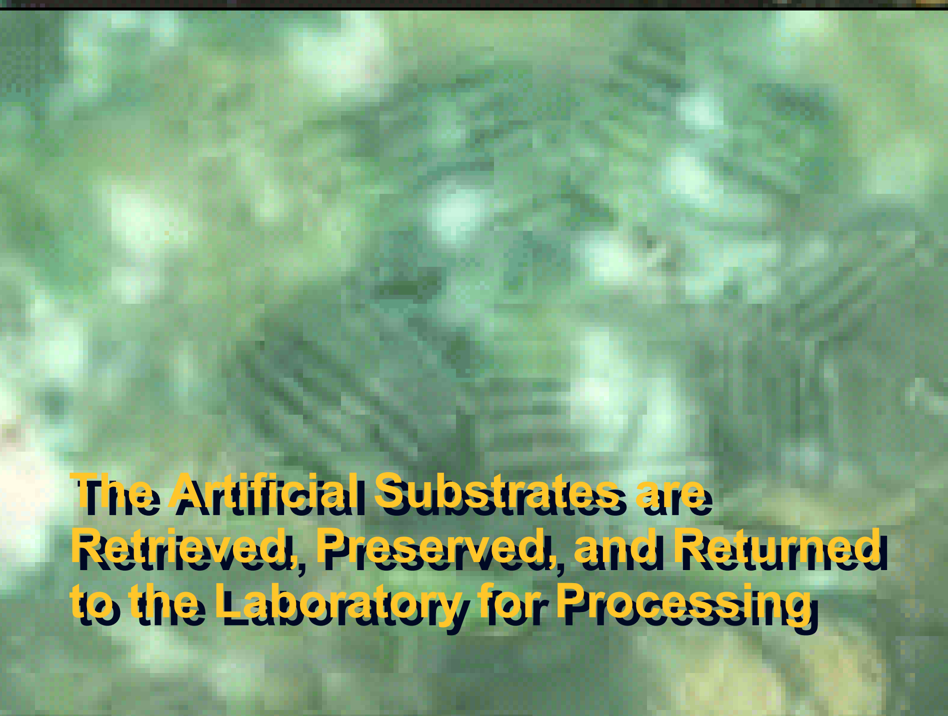
- Support water quality management needs, i.e., WQS, Permits, NPS, Planning, TMDLs at the watershed scale
- Determine status of Ohio's aquatic resources at the watershed scale (303d); aggregate "up" for 305b

Ohio EPA Macroinvertebrate Methods: Field Procedures

Artificial Substrates are Set for a Six-Week Exposure (July - September Index Period)



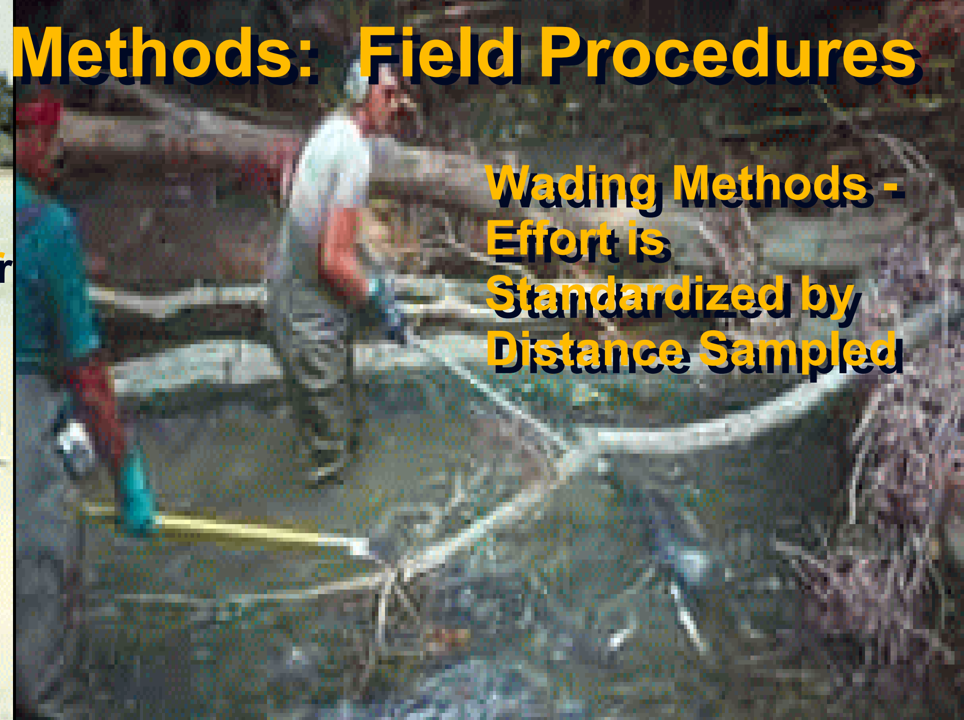
Artificial Substrates are Placed in Run Habitat With Constant Current



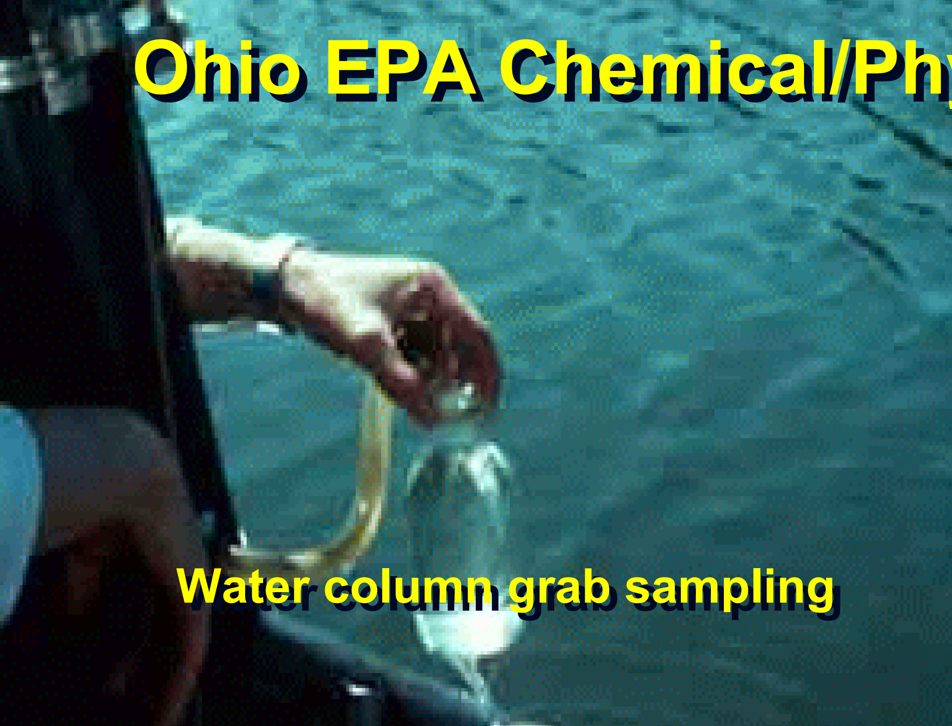
The Artificial Substrates are Retrieved, Preserved, and Returned to the Laboratory for Processing

A Qualitative Dip Net/Hand Pick Method is Used to Supplement the Artificial Substrates or as a Stand Alone Evaluation

Ohio EPA Fish Assemblage Methods: Field Procedures



Ohio EPA Chemical/Physical Field Procedures



Water column grab sampling

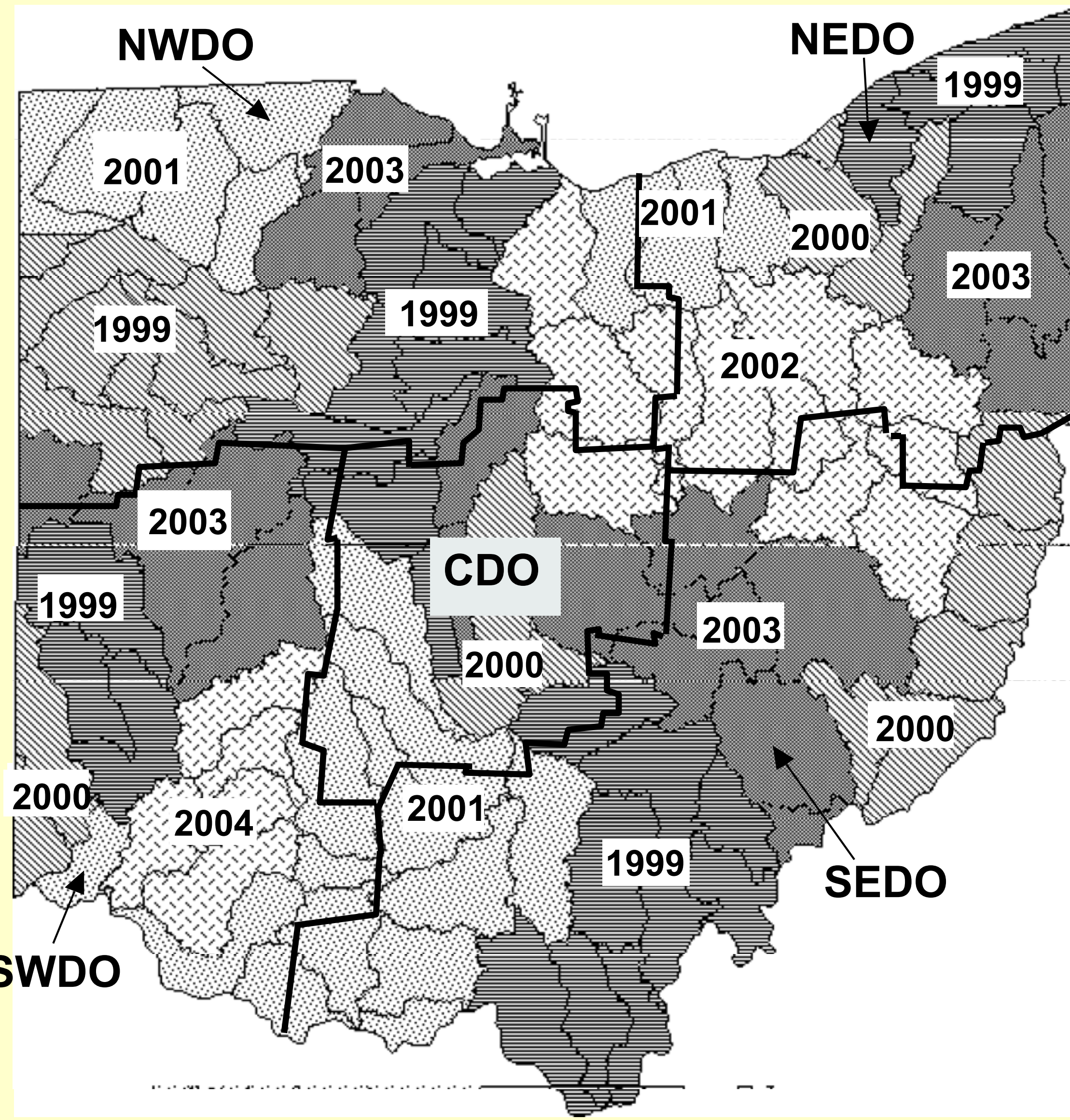
Depth integrated sampler

Automatic composite samplers

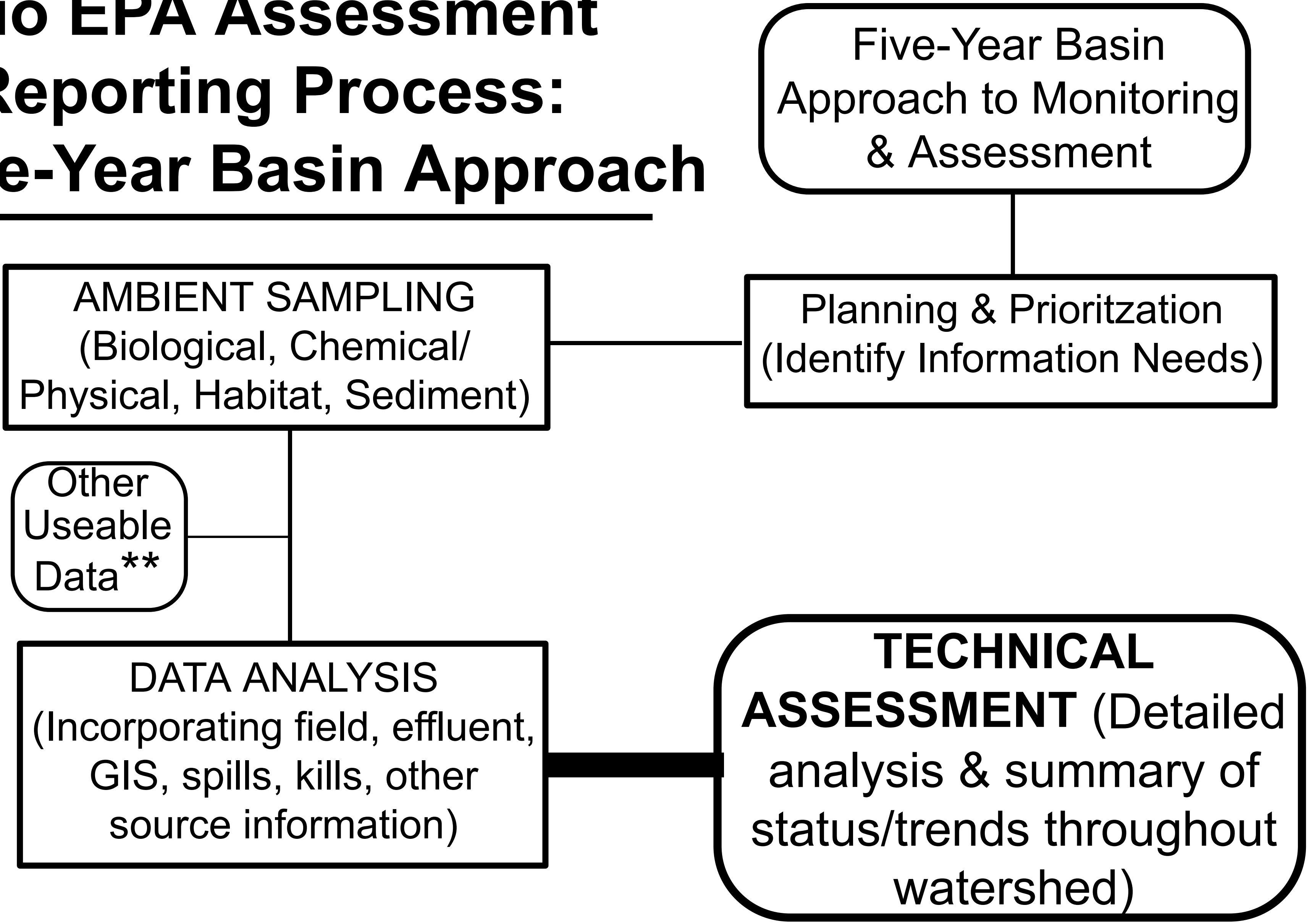
Time-of-travel dye injection

Ohio EPA 5-Year Basin Approach for Monitoring & Assessment

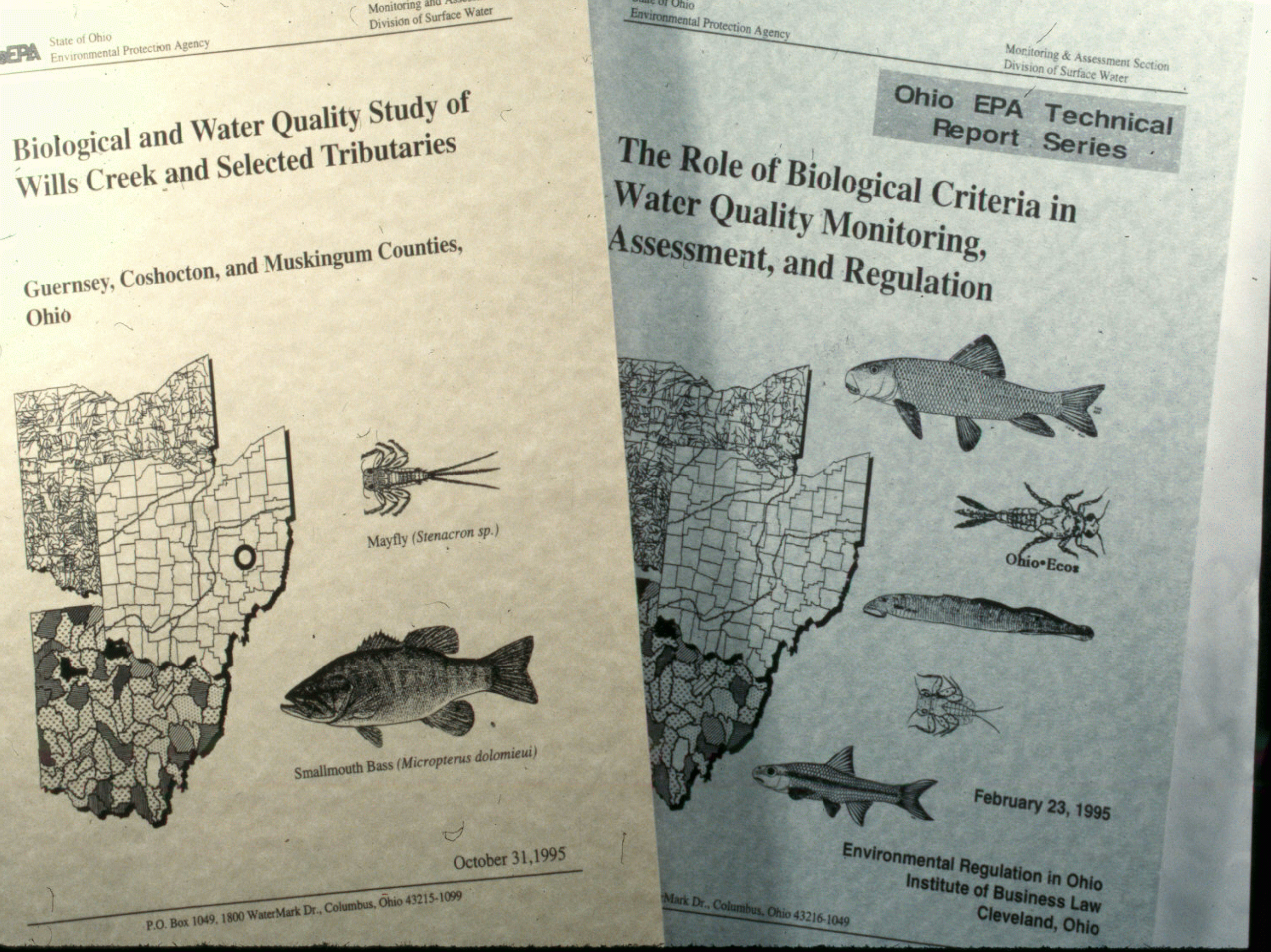
- Rotating basin approach for determining annual monitoring activities.
- **Systematic application of monitoring tools.**
- Initially correlated with NPDES permit cycle.
- Supports annual WQS use designation rule-making process (UAAs).
- Aligned with 15-year TMDL schedule in 1998.



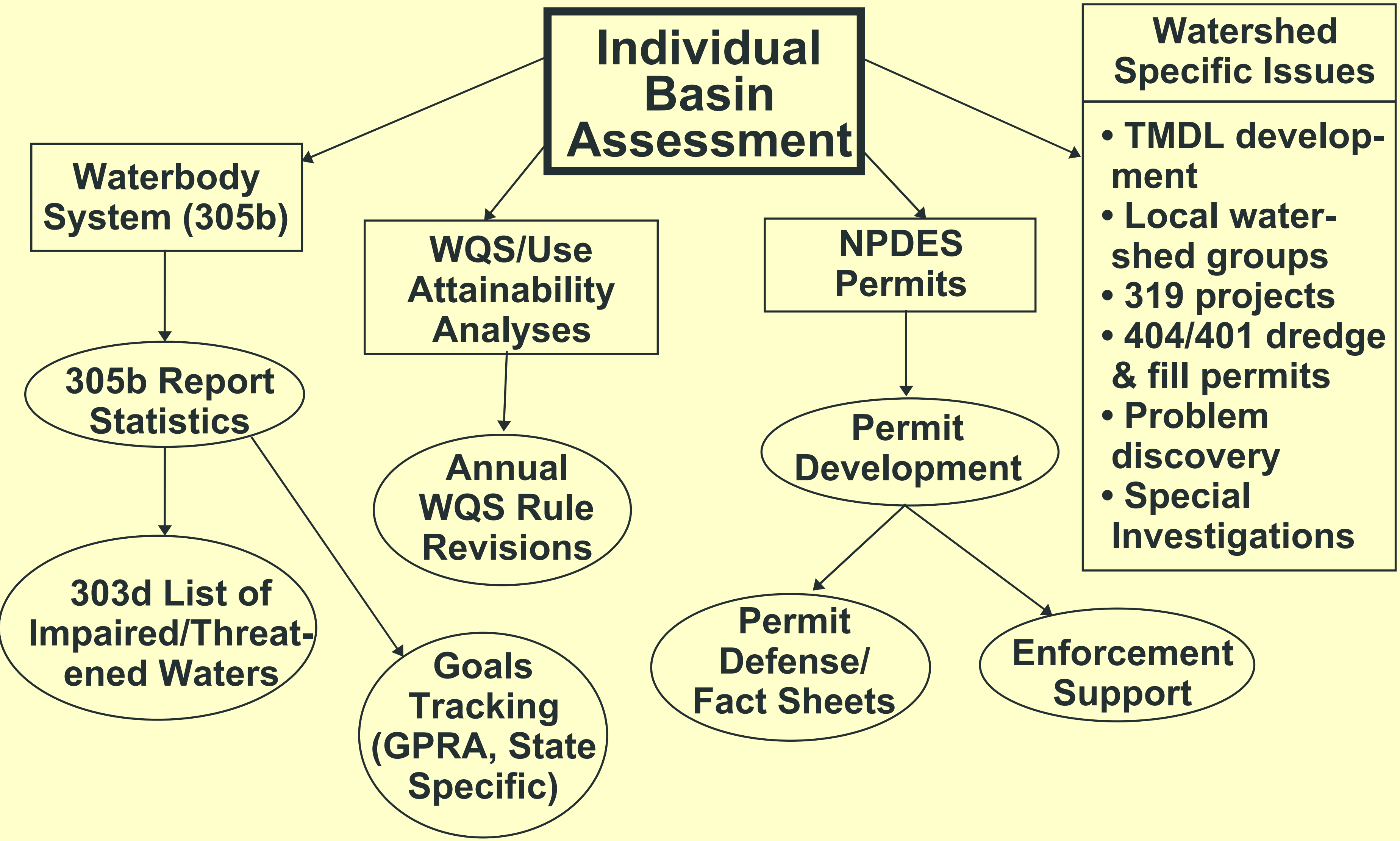
Ohio EPA Assessment & Reporting Process: Five-Year Basin Approach



** - Must meet Data Quality Objectives per Ohio EPA 5-Year Monitoring Strategy

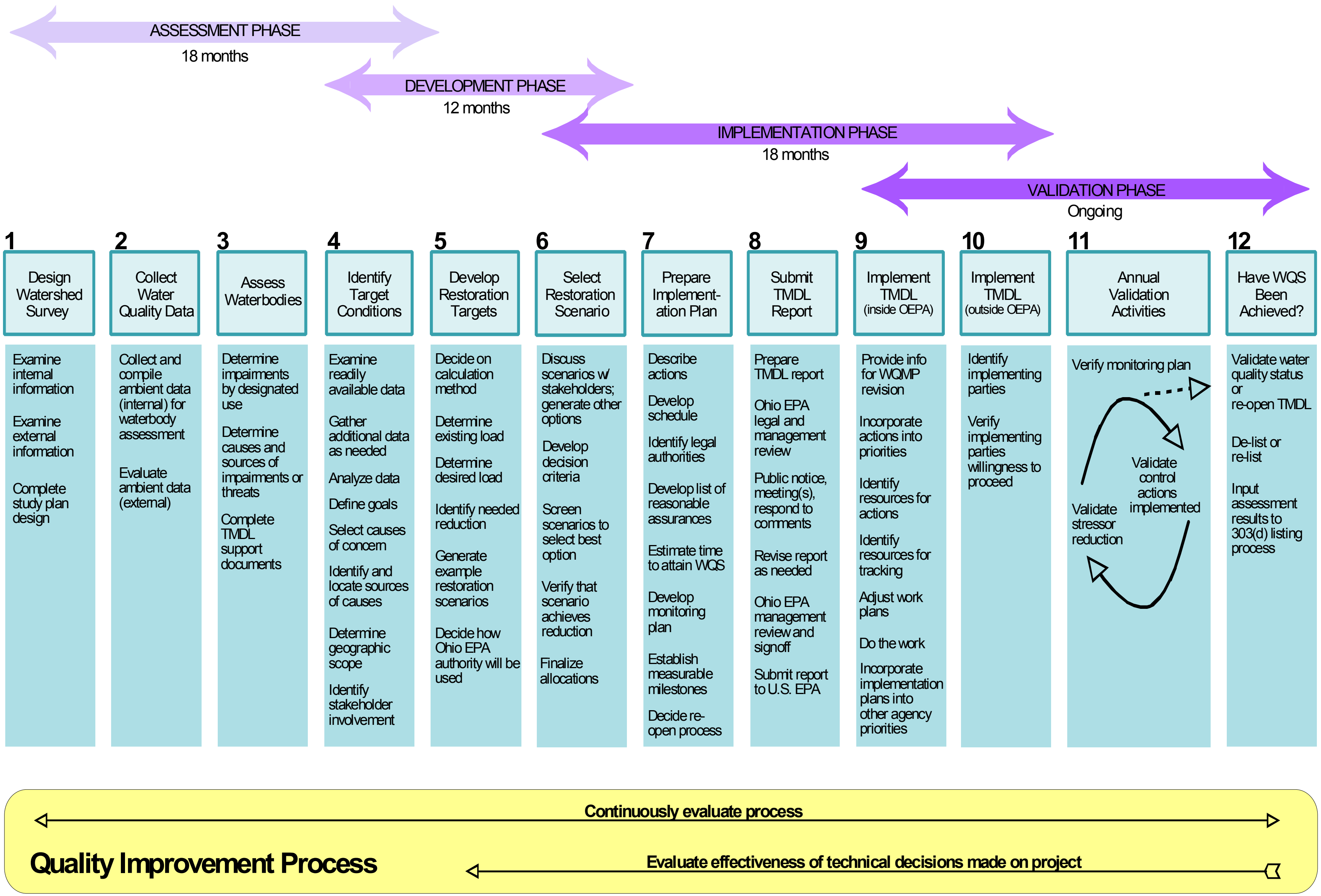

State of Ohio
Environmental Protection Agency
Monitoring and Assessment
Division of Surface Water
Biological and Water Quality Study of Wills Creek and Selected Tributaries
Guernsey, Coshocton, and Muskingum Counties, Ohio
Mayfly (Stenacron sp.)
Smallmouth Bass (Micropterus dolomieui)
October 31,1995
P.O. Box 1049, 1800 WaterMark Dr., Columbus, Ohio 43215-1099
State of Ohio
Environmental Protection Agency
Monitoring & Assessment Section
Division of Surface Water
Ohio EPA Technical Report Series
The Role of Biological Criteria in Water Quality Monitoring, Assessment, and Regulation
Ohio•Ecos
February 23, 1995
Environmental Regulation in Ohio
Institute of Business Law
Cleveland, Ohio
Mark Dr., Columbus, Ohio 43216-1049

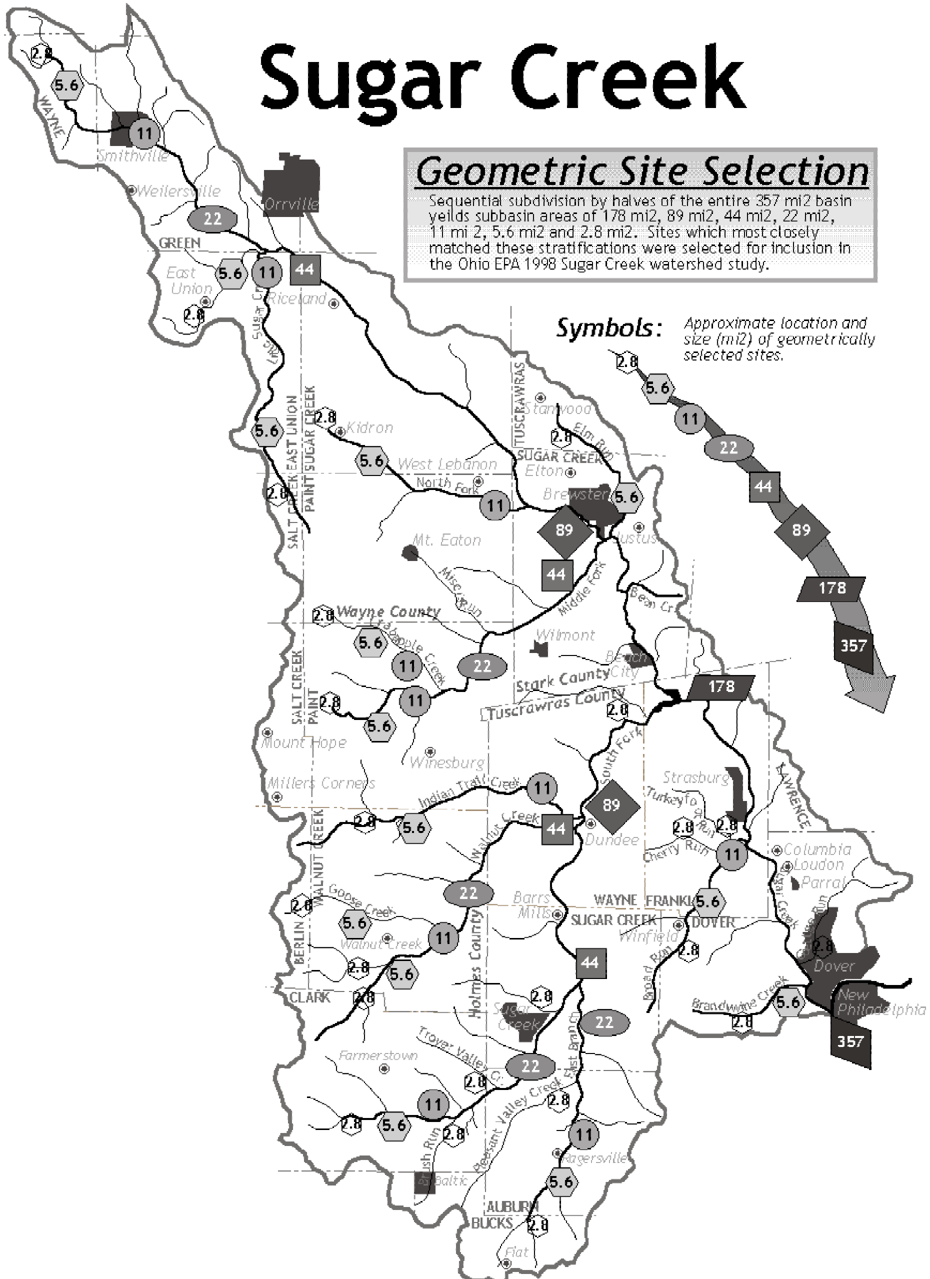
Functional Support Provided by Annual Rotating Basin Assessments



Overview of the Ohio TMDL Project Process

Numbers on chart correspond to detailed task lists contained in Appendix B

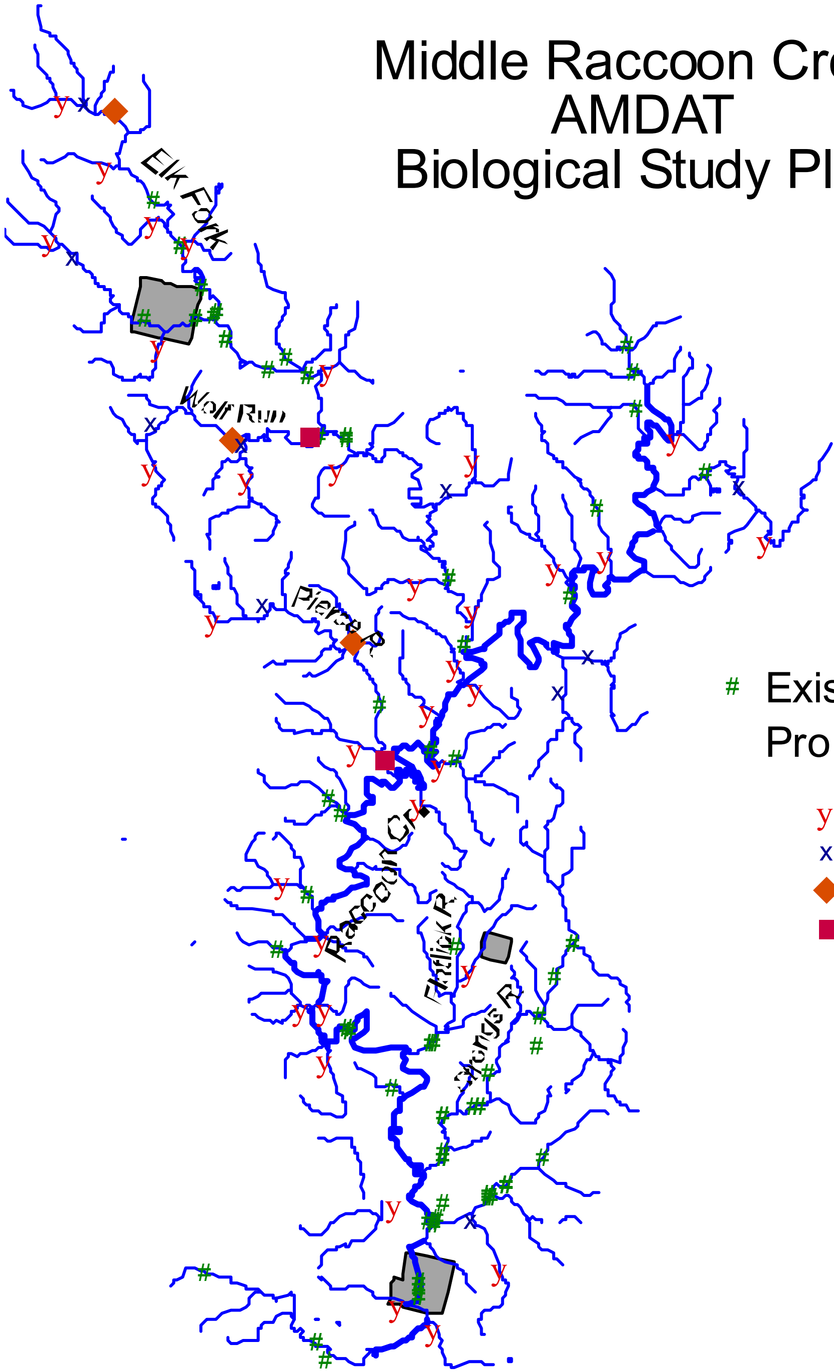




Sugar Creek Subbasin: Example of Geometric Site Selection Process

- Support 15 yr. TMDL development schedule beginning in 1998
- Augmented by 5-year basin approach database (1980-1997)
- Standardized biological, chemical, and physical tools and indicators
- Increased miles of assessed streams and rivers annually
- **Resolve undesignated streams**
- **Close 305b/303d listing gaps**
- **More comprehensive coverage of small streams (<5-10 mi^2**
- **Generate broader database for development of improved tools**

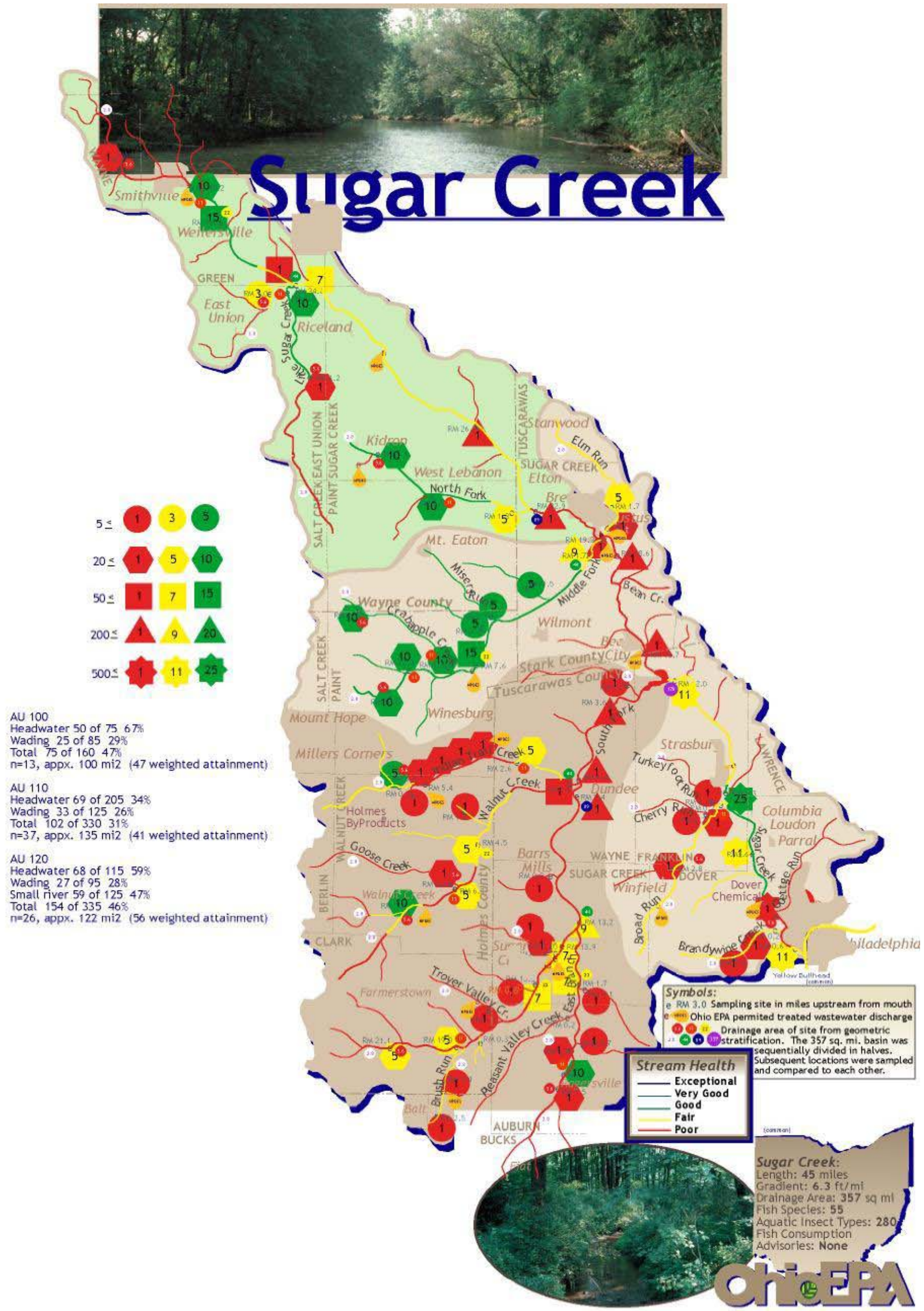
Middle Raccoon Creek
AMDAT
Biological Study Plan



\# Existing Biosurvey Data

Proposed Biosurvey Sites

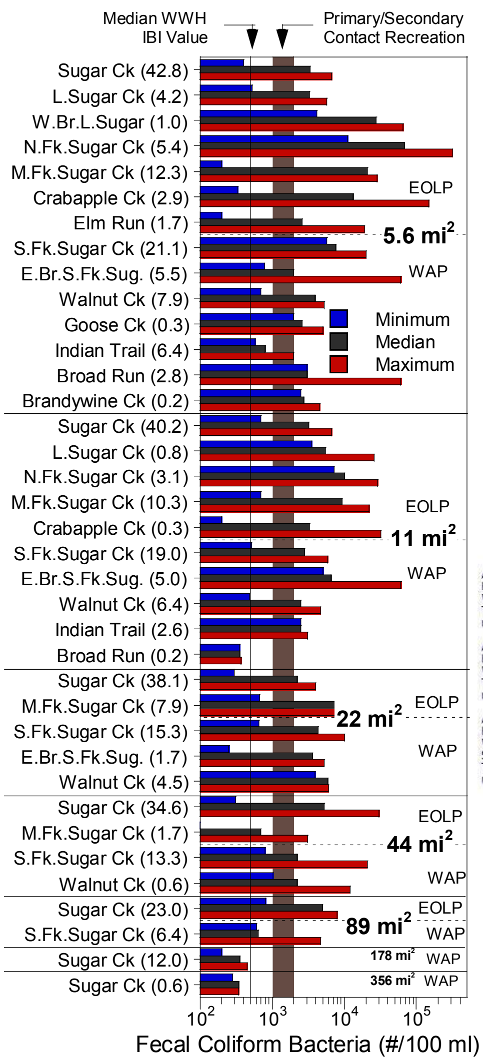
- y - 1.5 sq mi
- x - 3 sq mi
- ◆ - 6 sq mi
- ■ - 12 sq mi



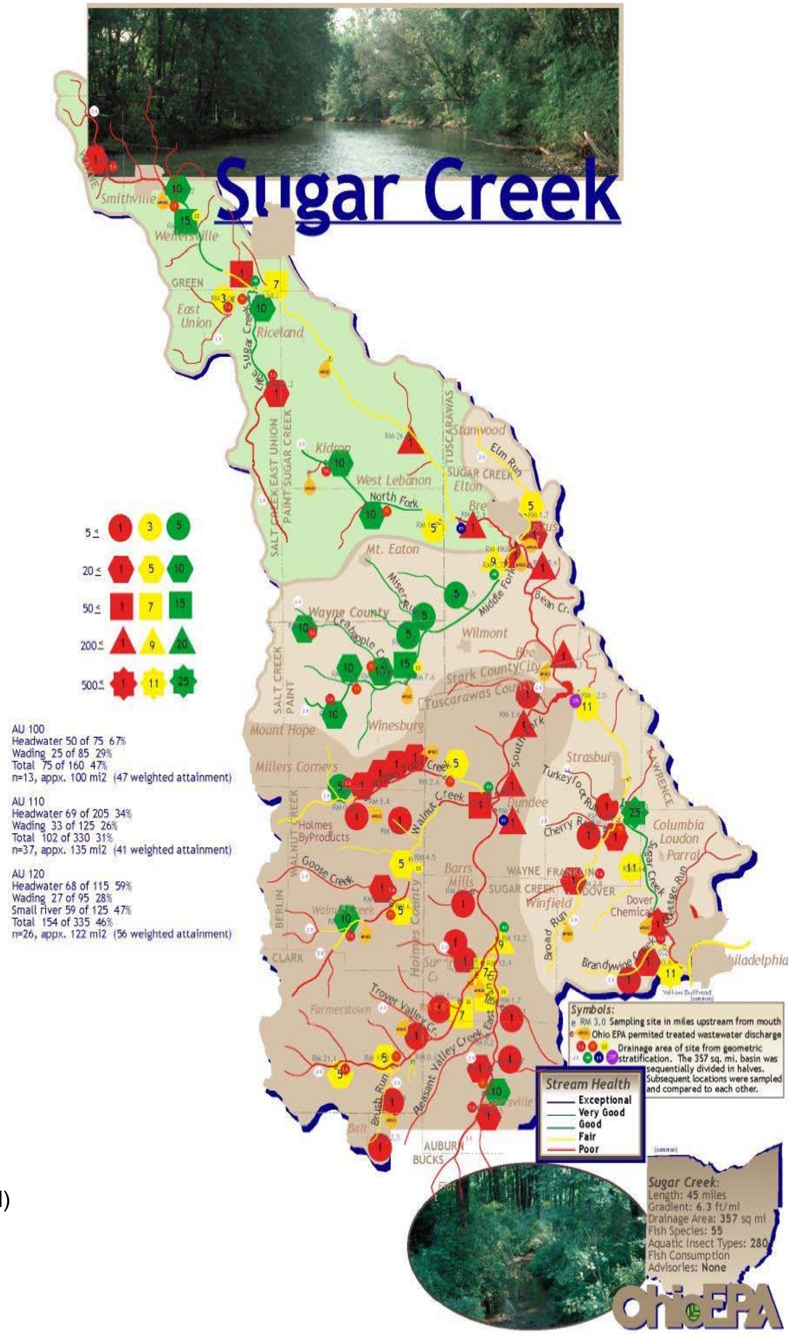
Sugar Creek Subbasin: Results of Geometric Design Assessment

- TMDL development scale: 11 digit HUC units, 328 statewide
- Mainstem rivers <500 mi^2 treated separately
- Watershed assessment results initially support UAA process
- Degree and severity of impairment then determined with biocriteria
- Causal associations determined via integrated analysis process
- **Supports prioritization ranking**
- More focused targeting of restoration activities
- **Local stakeholder "buy in" enhanced by scale of focus**

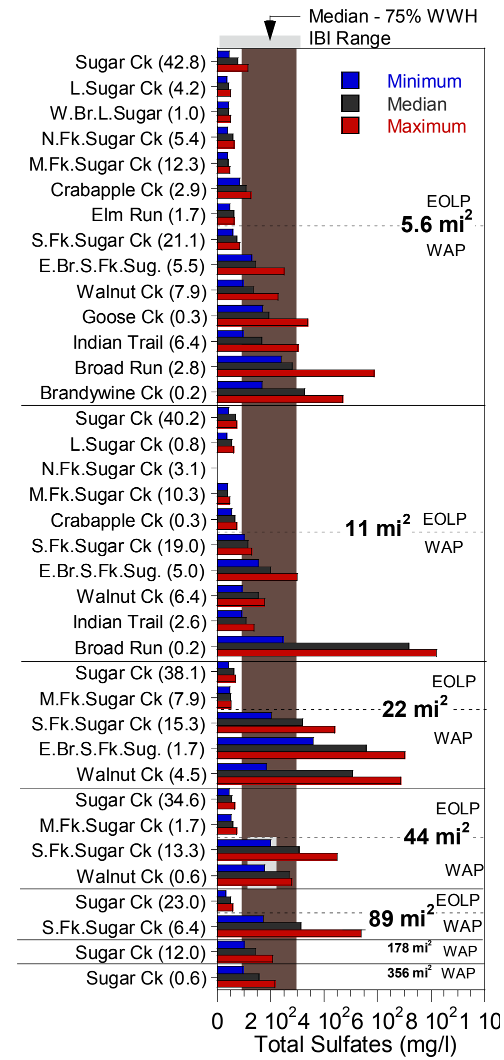
Livestock Impacts



Fecal Bacteria

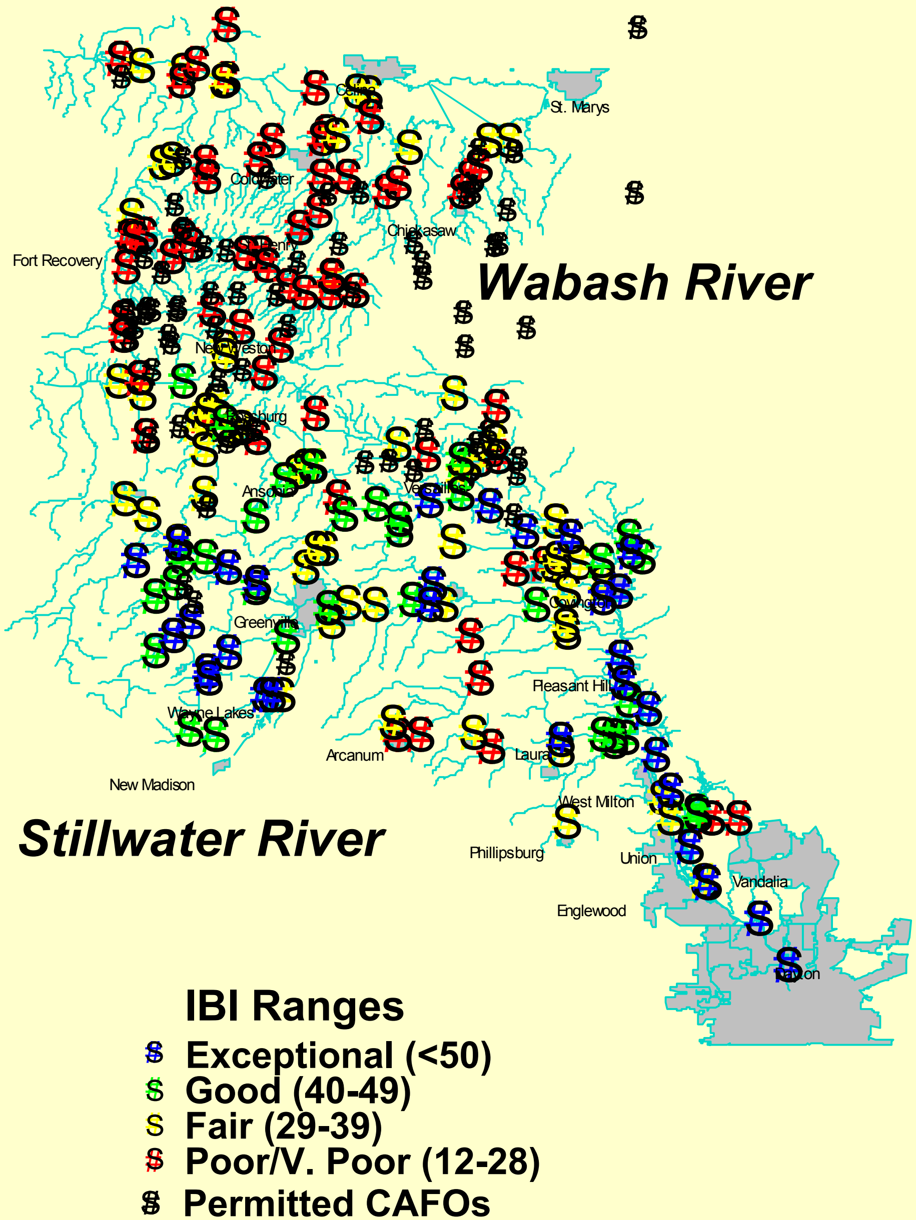


Mine Drainage Impacts



Sulfates

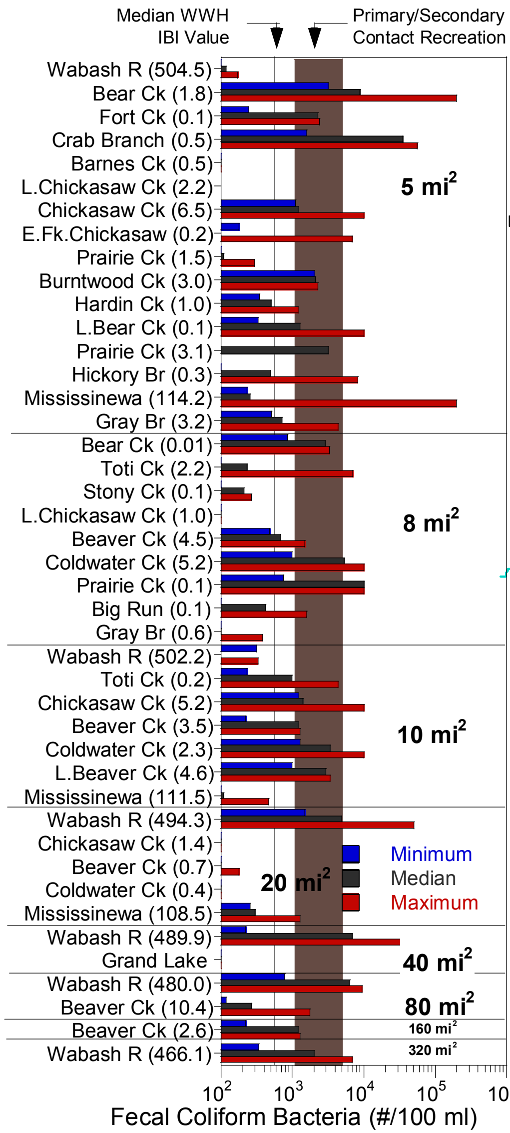
USING BIOASSESSMENTS TO DESCRIBE WATERSHED HEALTH



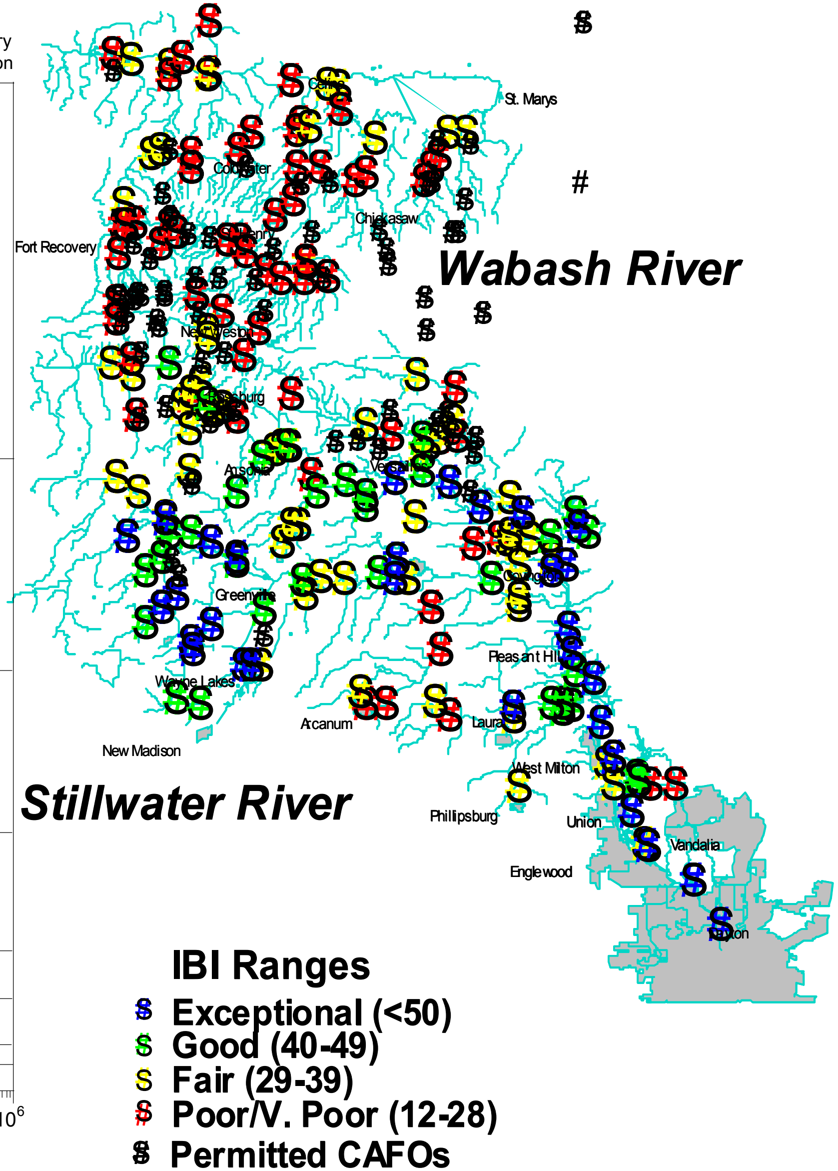
The Stillwater R. is classified and attains exceptional status (EWH) in the larger mainstem.

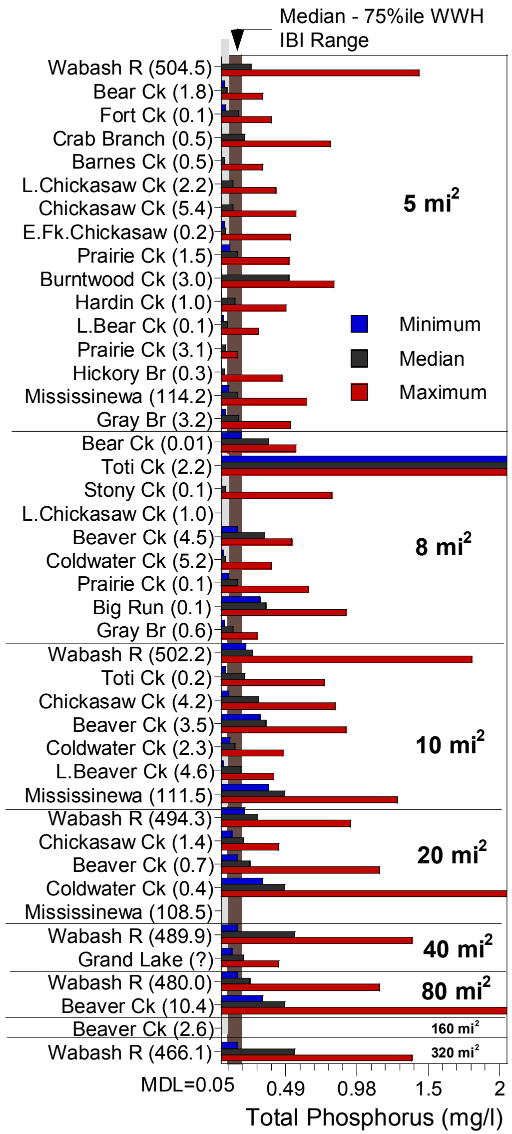
The cumulative effects of hydro-modification, riparian encroachment, and nutrient enrichment are associated with widespread impairment in the upper Stillwater and all of the Wabash subbasins.

CAFOs and Habitat: Cumulative Impacts



Fecal Bacteria

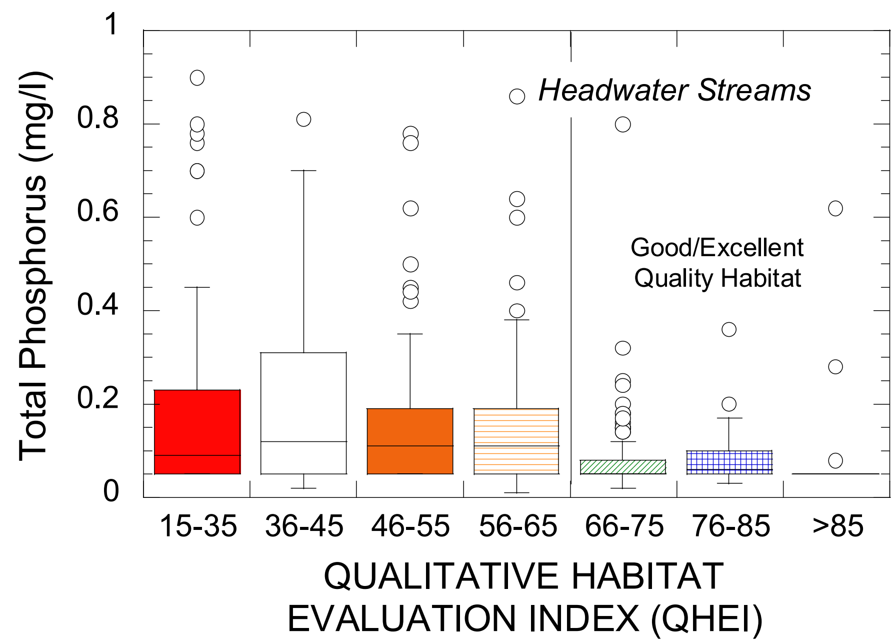


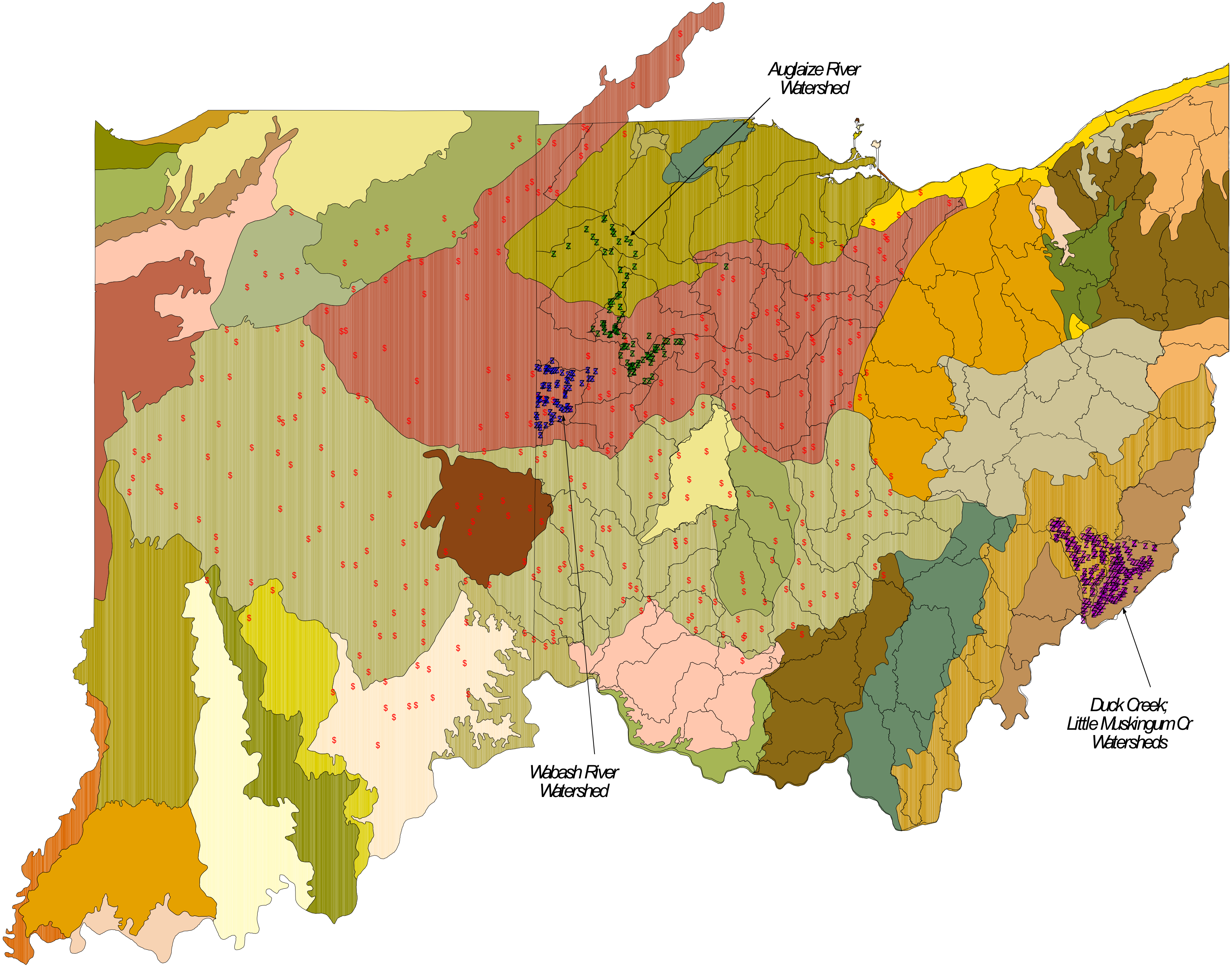


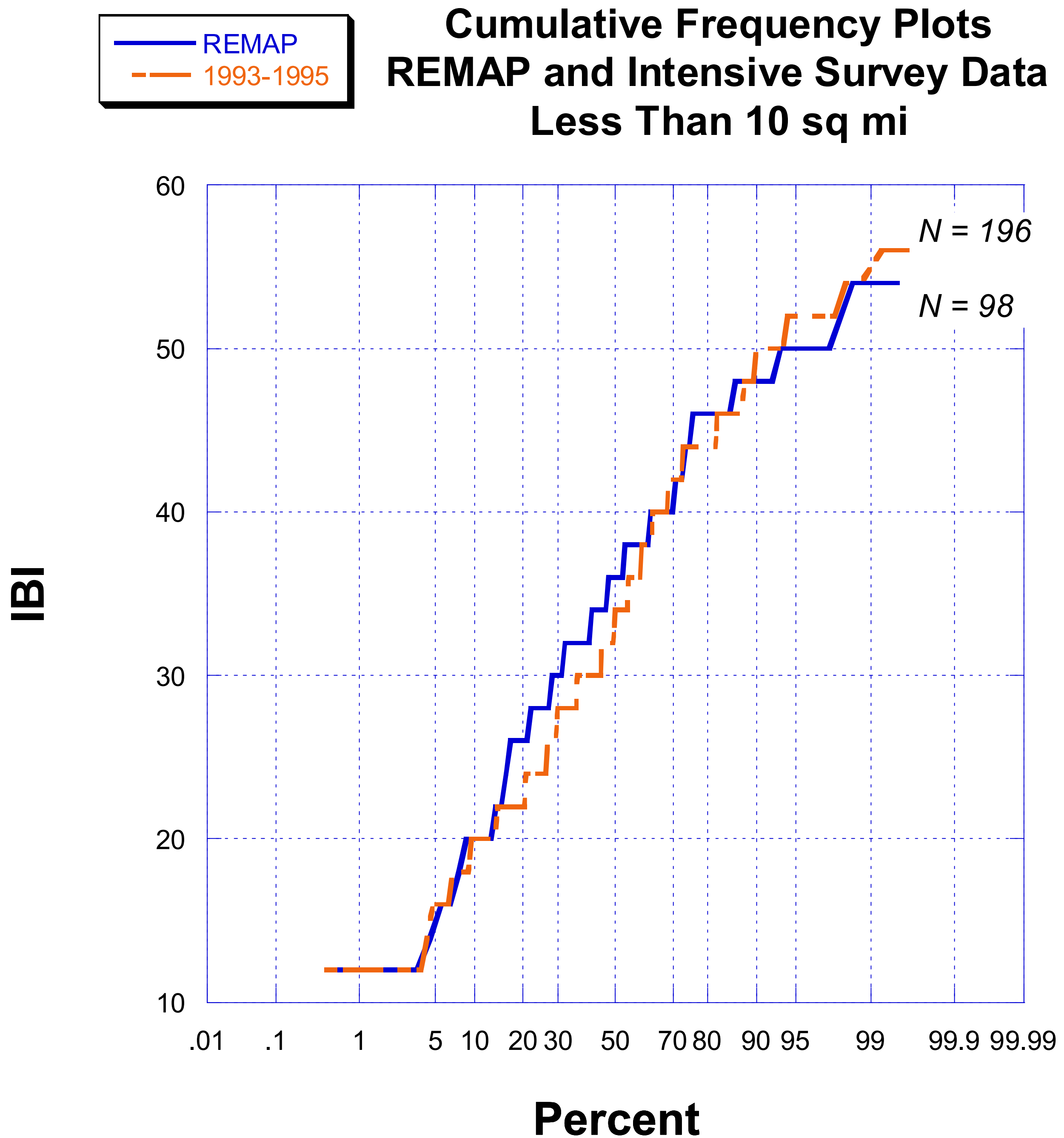
Total Phosphorus

The cumulative effects of habitat degradation and its associated consequences are frequently exported into downstream reaches resulting in reduced goods and services.

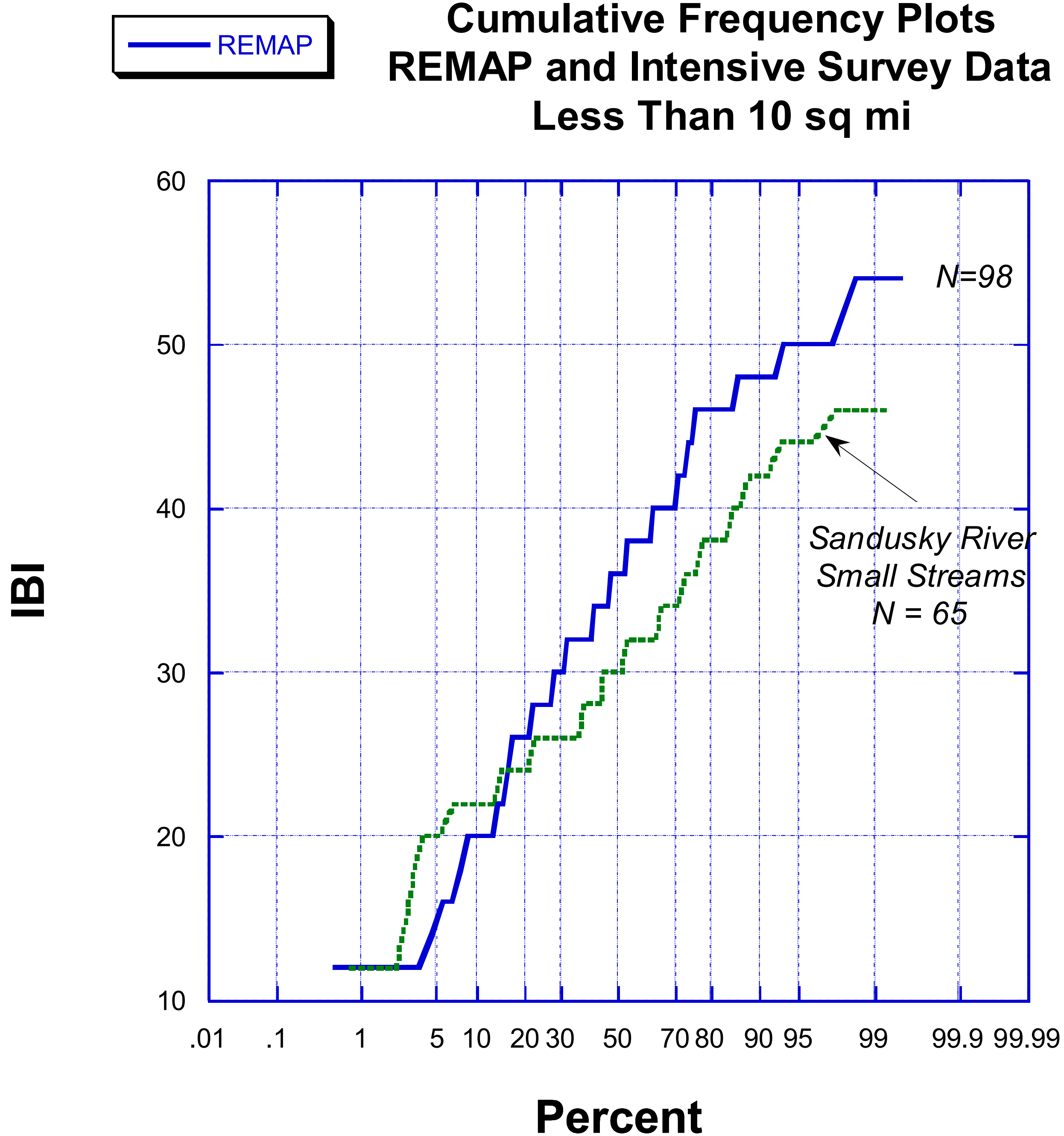
An example is the effect of headwater stream habitat on nutrient exports such as total phosphorus. The reduced ability of degraded systems to process and sequester nutrients can have downstream consequences.

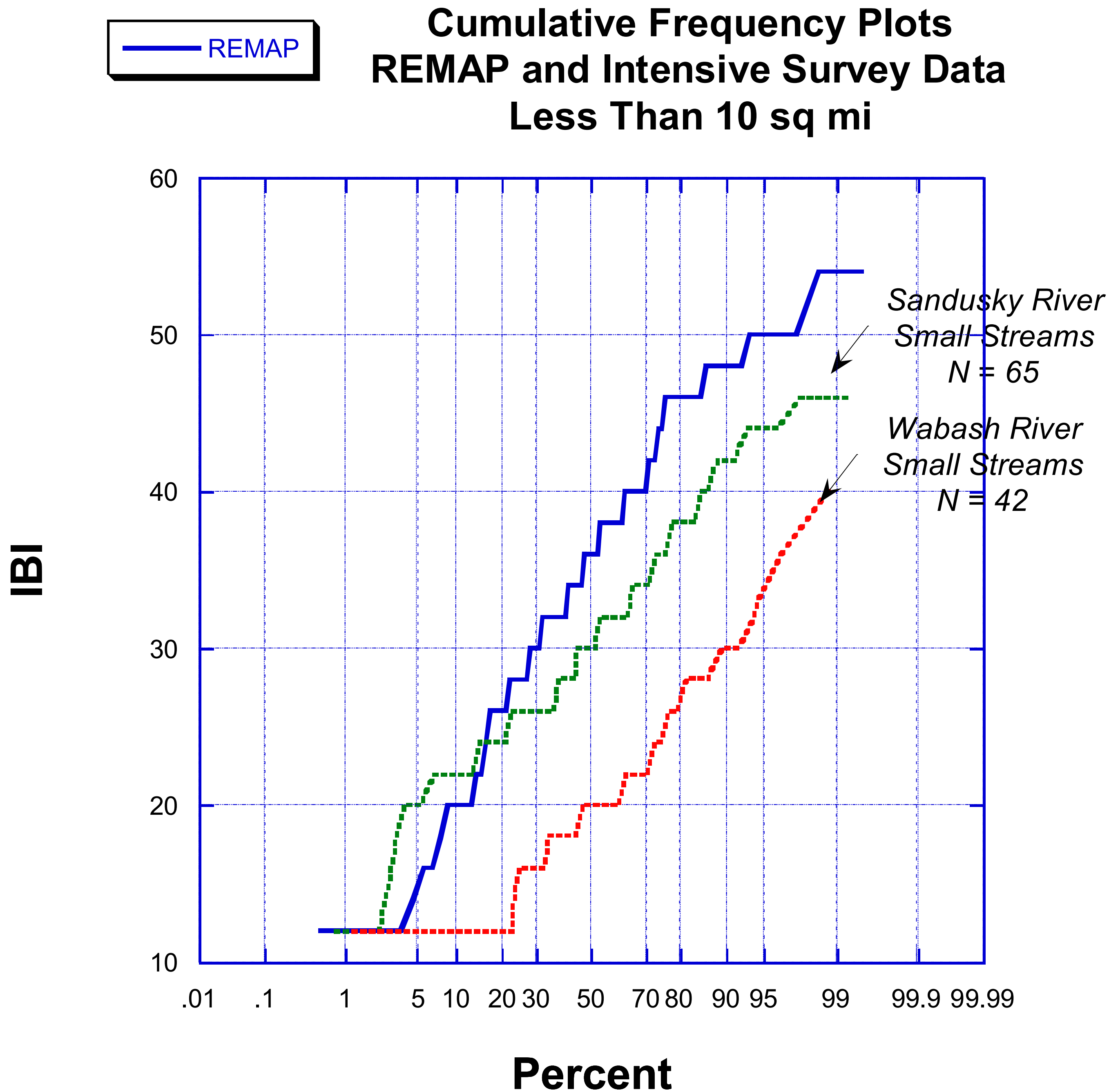


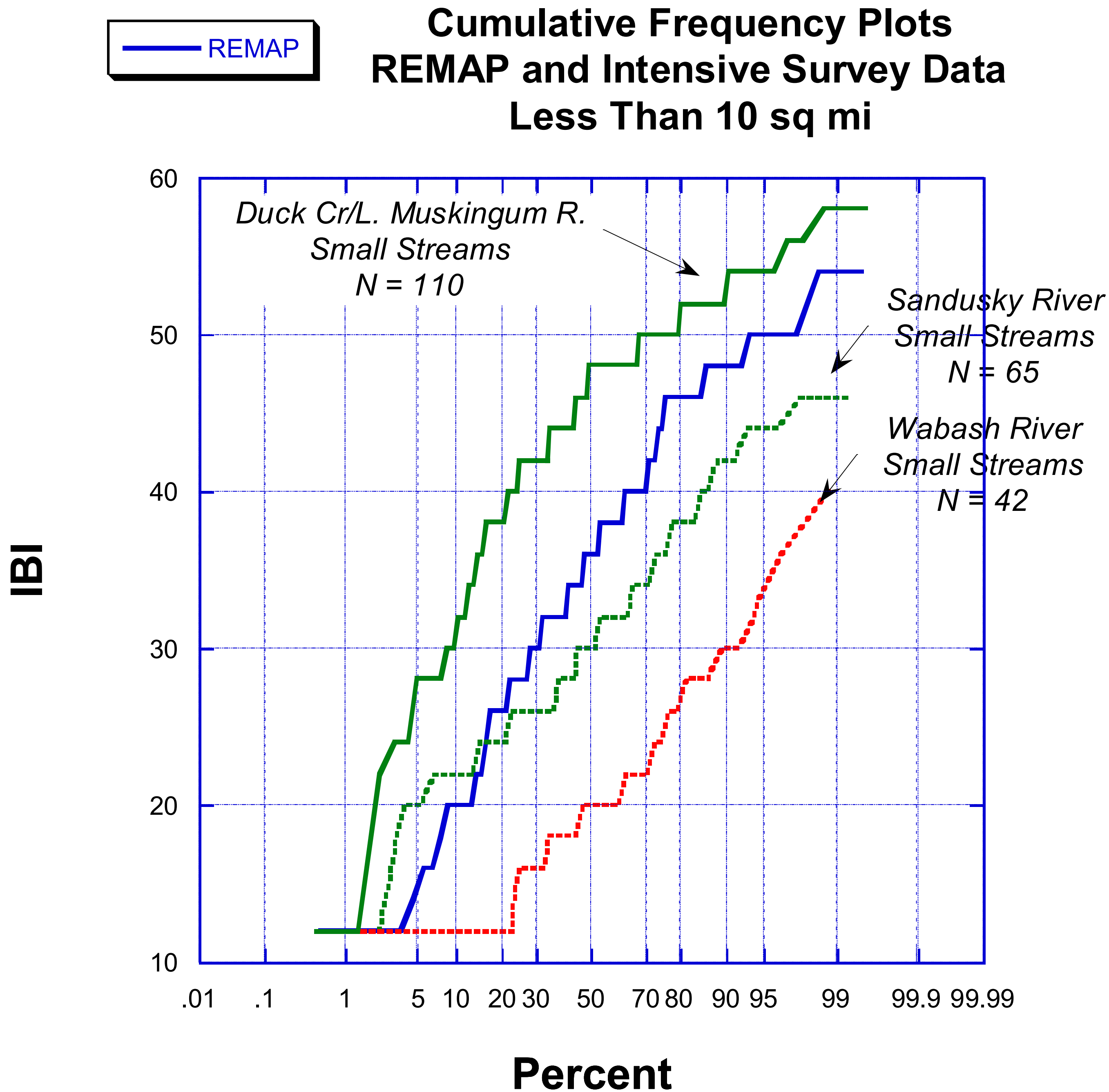

Auglaize River Watershed
Wabash River Watershed
Duck Creek; Little Muskingum Cr Watersheds


REMAP
1993-1995
Cumulative Frequency Plots
REMAP and Intensive Survey Data
Less Than 10 sq mi
N = 196
N = 98
IBI
Percent
60
50
40
30
20
10
.01
.1
1
5
10
20
30
50
70
80
90
95
99
99.9
99.99

Cumulative Frequency Plots
REMAP and Intensive Survey Data
Less Than 10 sq mi




REMAP
Cumulative Frequency Plots
REMAP and Intensive Survey Data
Less Than 10 sq mi
Sandusky River
Small Streams
N = 65
Wabash River
Small Streams
N = 42
IBI
Percent
60
50
40
30
20
10
.01
.1
1
5
10
20
30
50
70
80
90
95
99
99.9
99.99



REMAP
Cumulative Frequency Plots
REMAP and Intensive Survey Data
Less Than 10 sq mi
Duck Cr/L. Muskingum R.
Small Streams
N = 110
Sandusky River
Small Streams
N = 65
Wabash River
Small Streams
N = 42
IBI
Percent
60
50
40
30
20
10
.01
.1
1
5
10
20
30
50
70
80
90
95
99
99.9
99.99

Benefits of Geometric Site Selection Process

- Resolve UAA and impairment assignments prior to TMDL development
- Organizes watershed issues in proportion to the occurrence of resource types
- Corresponds to local scale of management and implementation
- Prioritization can account for severity and extent of impairments and threats